Walther, whether they are a sufficiently exhaustive compilation to inspire thorough confidence.

For example, the information as to the geographical distribution of species is rather unequal, being detailed in some cases, and decidedly meagre in others, as when for *Lagena sulcata* is given only "im Mittelmeer," and when for *Crania anomala* the only north-west European locality is the Clyde! While, on the other hand, such minute local detail is given as that *Globigerina bulloides* is not uncommon in the brackish water of the Dee from Chester to Hilbre Island. A number of detailed criticisms of this kind might be made, such as the extraordinary entry "*Lafoëa*, 450 faths." when several species of the genus are found in quite shallow water. But probably enough has been said to show that the lists are by no means complete.

The plan of the book is, briefly, as follows: first, the gaps in the palæontological record, and their causes, are discussed; then the following groups are treated in succession: Foraminifera, Radiolaria, Spongia, Anthozoa, Crinoidea, Asteroidea, Echinoidea, Holothuroidea, Bryozoa, Brachiopoda, Lamellibranchiata, Gastropoda, Cephalopoda, and Crustacea. A few general questions are discussed. The author alludes to the well-known fact that some of the most abundant groups in the sea are almost unrepresented in the fossil series, and that even amongst animals with hard parts the fossils of a particular bed might inadequately represent what had been the living assemblage at that spot. He quotes Edward Forbes' account of the natural history of a shell-bed off the north-west of the Isle of Man, and his later observations in the Ægean Sea, to show that even the fresh dead remains of organisms on the sea-floor do not always correctly show the relative abundance of the living species.

In each group, after a short account of the characters, mode of occurrence, &c., there follows a list of genera and species, with an indication of the distribution and range in depth, compiled from *Challenger* reports, monographs, and other sources; but there is a want of correlation and digestion of the facts, the nomenclature is not up to date, and the same species sometimes occurs several times under different names; *e.g.* on p. 308, *Ophiothrix fragilis* appears three times under the names *Ophiocoma rosula*, *Ophiothrix fragilis*, and *Ophiothrix rosula*, with a different range in depth each time. Occasionally an animal is found in the wrong group altogether, as, a Holothurian amongst the Asterids, and an Ascidian in the Gastropods. However, Prof. Walther has brought together a considerable amount of material which those who are interested in the distribution of animals in the sea, and the association of species to form "faunas" characteristic of particular regions, will have to utilise. For this the marine zoologists and the geologists will no doubt be grateful, and will, with profit, consult the lists; but I fear they will also sometimes regret that the author had not taken more pains to digest his facts and to correct his proofs. Many odd pieces of interesting information are given; but there is still room in some book on marine faunas for a detailed account of characteristic assemblages of animals with as full a description as can be given of their physical surroundings and their variations.

W. A. H.

OUR BOOK SHELF.

Elementary Qualitative Chemical Analysis. By Prof. Frank Clowes, D.Sc., and J. B. Coleman. Pp. 180. (London: J. and A. Churchill, 1894.)

Tables and Directions for the Qualitative Chemical Analysis of Moderately Complex Mixtures of Salts. By M. M. Pattison Muir, M.A. Pp. 44. (London: Longmans, Green, and Co., 1895.)

Laboratory Exercise Book for Chemical Students. By E. Francis, F.C.S. (London: Blackie and Son.)

THE first of these books is an abridgement of Prof. Clowes' text-book on qualitative analysis, adapted for use in the laboratories of schools and colleges. For the most part, the book is like a host of others of the same kind. It differs from many of them, however, in the fact that the first fifty pages is devoted to instructions on the preparation of apparatus, to experiments illustrating the preparation and properties of certain gases and liquids, to descriptions of analytical operations, and directions for the performance of ordinary processes of chemical manipulation. Work of this character forms by far the best introduction to a course of practical chemistry, and it has an educational value, which is more than can be said for mere test-tubing. On account of this and one or two other notable features, the book will probably take a permanent place among laboratory guides.

"These tables and directions" (writes Mr. Pattison Muir) "are intended for the guidance of students who are acquainted with the principles of qualitative analysis, and who are able to make a qualitative analysis of a simple salt, and of a mixture of salts containing not more than a single metal in any one group, and three or four of the common acids." The student who has passed through an elementary course of practical chemistry is frequently puzzled how to conduct an analysis of moderately complex mixtures of salts and the commoner metals and acids, or an analysis of metals and alloys. Mr. Muir's book tells exactly what to do in such cases. By following the directions given, it would hardly be possible for the young analyst to go wrong. The processes described are easily carried out, and are concisely stated. A point worth noting is that the formulæ of solids are printed in heavy type; of liquids or substances in solution, in ordinary type; and of gases, in italics. This method of indicating the physical states of substances certainly possesses advantages. Altogether the book is a handy and trustworthy manual for analytical chemists.

The exercise book arranged by Mr. Francis has apparently been designed to take the place of the laboratory note-book. It opens with a few exercises in practical chemistry, the experiments being briefly—sometimes too briefly—described; and blank spaces are left for the entry of results. Then come a set of analytical tables, and a number of blank forms in which all the steps in the analysis of a mixture of two simple salts are indicated, spaces being left for the student to fill up with his inferences. The average student of practical chemistry works like a machine now, and we have no doubt that these tables will be after his own heart, for they only leave him to fill in his observations as if he were answering the questions in a census paper. The book may serve to drill the student into carrying out his tests in the proper order, but it will not benefit him mentally.

Elements of Astronomy. By G. W. Parker, M.A. (London: Longmans, Green, and Co., 1894.)

THIS is one of the books in which astronomy seems to be regarded as a subject which is to be studied much in the same way as one would take up an additional book of Euclid. It abounds in definitions, propositions, and

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corollaries; the diagrams of instruments scarcely give any ideas of what they are intended to represent; and the descriptive part of the subject might have been omitted without much sacrifice. The ground covered is that which is ordinarily understood by an elementary treatment of mathematical astronomy, dealing chiefly with the considerations relating to the positions, movements, dimensions, and distances of the various heavenly bodies, but includes also some very scanty references to their telescopic appearances. On the whole, the various points are clearly, though shortly, explained, but there is much to suggest that the author would be all the better for some little observatory practice; for example, his method of determining the angular value of a micrometer by means of the sun (p. 48) is scarcely practicable, and a sun-spot 13,000 miles long is by no means to be classed as one of the largest spots (p. 68). It may be pointed out, also, that a single observer, by observing at intervals of twelve hours, gets better results for the parallax of Mars than two working in the way indicated on p. 115. A ship's mean time at sea, too, is usually determined by one observation near the prime-vertical, and not by the method of equal altitudes.

In less than a dozen pages the author attempts to give an idea of the classification of the stars, and of "the principal discoveries which have been made in modern times, chiefly by means of spectroscopic analysis, with their nature and physical condition" (p. 203). The omission of the solar prominences in an account of the phenomena of a solar eclipse, is a good indication of the very feeble character of this chapter.

The book is intended specially for students preparing for University examinations, and by such it may be found useful.

LETTERS TO THE EDITOR.

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Exploration at Ruwenzori.

PERHAPS it may interest your readers to give a short account of Ruwenzori, where I have now spent four months. The mountain is a very difficult one to study, on account of the difficulty of reaching the most interesting part. Taking a sort of botanical section from the shore of the Albert Edward Nyanza, one finds first a series of grassy plains covered with Andropogous some two feet high, and in certain months supporting large herds of elephants, Kudu, and Lurwali antelopes. This is in part the old level of the lake, and in part gravel and sand brought by the numerous rivers; in places it is dotted by Acacia and the tree Euphorbia, which has something of the appearance of an enormous chandelier. After leaving this plain, one comes to a series of small hills from 4000 to 5000 feet in height, which have been apparently cut out of the mountain by the numerous rivers and streams. Some of these are covered with patches of cultivation, banana plantations, &c.; usually these are hidden from the main road. When one reaches the mountain proper, one finds up to 7000 feet a steep ascent covered with grass and small shrubs, usually three to four feet high. The valleys in this part are usually very steep V-shaped trenches, and cultivation is abundant everywhere, sometimes over 7000 feet, and in the Wakondja country the edible Arum is grown up to 7400 feet or more. This height, 7000 to 8000 feet, marks the beginning of the forest. It is composed of deciduous trees, sometimes with a very thick undergrowth; sometimes it is pretty open, with a profusion of fern and moss on the old trunks, and creepers in some places. I have found tree ferns and Begonia, but usually the flowers are rather pale in colour, or quite inconspicuous. At 8600 feet another distinct change takes place, and a wilderness of decaying young and mature bamboos replaces the trees. Here and there these are hung with creepers, but the predominant feature is the wetness of everything. Moss covers almost every trunk below, and amongst the roots are only very watery plants, such as Urticaceæ. At 9600 feet another change takes place; bamboos disappear completely, and tree heather takes its place. In a dry part of the mountain one finds a charming little violet, a Cardamine, Galiums, Epilobium, Rubus, &c. In wetter places one finds a regular peat-moss with Sphagnum, beautiful orchids, and short heather; in another place one will find enormous trees of heather, usually gnarled and twisted in growth—tree Senecios, tree Hypericums, &c. This region seems to extend to the snow (which, I am sorry to say, I have not been able to reach). On my highest attempt, I could see the heather trees apparently higher than the snow. On another attempt to get to the summit, I found what seems to me *Alchemilla alpina!* One feature of the mountain is the extreme scarcity of animals and birds. In the lower forest there are bushbuck, baboons, and two other sorts of monkeys; one the magnificent black and white-furred kind from which grenadiers' shakos were made, and another with short slatey fur, which is new to me.

Perhaps the commonest birds are the sunbirds; one green, yellow, and crimson, I have seen above 10,000 feet, and I have also seen (though I am almost afraid to say it) a robin, and a goldfinch.

As to the geology of the mountain, I do not care to risk an opinion at present, but I have taken many specimens which I hope may solve some of the questions. I think glaciers must have extended seven to eight miles down two of the valleys, but there was no evidence to my mind of any extensive glaciation. I think I am right in saying that the Salt Lake is nothing but an extinct volcanic crater, and in several places along the east side of the mountain there are others, or a small chain of volcanoes; usually the chain radiates from the centre of the mountain.

I hope to start to-morrow for Ujiji, my object being to see whether a practicable route exists from Tanganyika to the Albert Edward Nyanza. I only hope I shall be able to bring my collections safely home. G. F. SCOTT ELLIOT.

Salt Lake, Ruwenzori, August 2, 1894.

The Alleged Absoluteness of Motions of Rotation.

I MUST confess that discussions upon mathematical metaphysics appear to me to be somewhat unpractical. They are suggestive of the case upon which Serjeant Snubbin was engaged, which related to a right of way "leading from some place which nobody ever came from, to some other place which nobody ever went to." Nevertheless, I propose to offer some remarks upon this subject.

That *absolute* motions of translation and rotation exist appears to me too clear for argument; but whether our senses are capable of taking cognisance of them and reducing them to exact measurement, is quite another matter. The view advocated by Prof. Greenhill appears to be that motions of rotation are determinate—that is to say, they are capable of exact measurement within the limits of experimental error; whereas the contrary is the case with motions of translation. Mr. Love, on the other hand, holds that neither kind of motion is determinate in the above sense. Now a knowledge of the absolute value of the velocity of translation of any object involves a knowledge of the magnitude and direction of the sun's velocity in space; and until the latter has been determined, which has not yet been done, the former is necessarily unknown. It therefore follows that all motions of translation of which our senses are capable of taking cognisance are *relative*.

On the other hand, the motion of rotation of any object is independent of the motion of translation of the sun or any other body. If, therefore, it were in our power to construct a system of axes which either move parallel to themselves or whose angular motion is known, it would be possible to determine the absolute value of the angular velocity of any object. But even if it were possible to devise an experiment by which such a system of axes could be obtained, our results would only be accurate within the limits of experimental error. It may, therefore, be well to point out that, without inventing any new experiment, the angular velocity of any object may be accurately determined *within the limits of experimental error* in the following manner.

Select two stars, X and Y, whose proper motions are so minute that they have never been detected by the most refined observations. Through the sun and the two stars draw a plane, S X Y, and through the sun draw a line, S Z, perpendicular to

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